

ART. VII.—*A Study of the Guttural Pouches of Horse.*

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[Read 26th May, 1910.]

A knowledge of comparative anatomy is apt to induce the belief that many of the variations of structure existing in different species of animals is due to some form of force operating on animal tissues. An excellent example of force dominating shape is displayed in the thorax of the horse. The weight of the horse is largely carried on the sides of the ribs, from which results a lateral narrowing of the thorax and a driving backward toward the loin, of the lung; consequently it becomes necessary for the horse to carry eighteen pairs of ribs, so that the thoracic content may be accommodated. Man's upright position has removed lateral, restricting forces from the sides of his chest; the lightness of lung tissue, unrestrained by such pressure, has caused the human lung to encroach on the neck. It is noteworthy that with ascent of the lung in the neck only twelve pairs of ribs are found, and the last or lower rib usually showing atrophic changes.

Cervical ribs are occasionally found in men and in women; they are, however, reported to be three times as common in women as in men. Whether they exist in aboriginals I do not know. The fact that the costal breathing of cultured women is said not to occur in native races leads me to think that in all probability cervical ribs are commonly found associated with atrophy of the upper limb. Surgeons have removed these neck ribs for the relief of pain. This pain is regarded to arise from stretching of the brachial plexus and the subclavian artery; it is not improbable that pain may occur during the development of these structures from an irritated pleura. From this irritated pleura arises the demand for a rib to protect the unprotected lung, and the pain arising from the same source

splints the area whilst the rib accustoms the structures, into which it is thrust, to the annoyance of the invasion.

I have prefaced my remarks on the guttural pouches of horses by this reference to force operating on the chest because it sheds some sidelight on the more hidden force effects calling into existence the bernal modifications of the auditory tube of the horse. Between the lateral and median fibro-cartilaginous laminae of the auditory tube the mucous membrane of the tube finds its exit, in sac form, into the retropharynx. Such an escape of the mucous implies an atrophy of the membranous lamina of the auditory tube. The cause of this atrophy cannot at once be seen by dissection. Searching these tissues to find the cause of this obliteration of the membranous lamina we are struck by two remarkable features in and about the throat of the horse. First the narrowness is almost as striking as the great depth of the inter mandibular space; secondly, the stylo-hyoid bone (epihyal) reaches its highest development in the horse. Upon these two facts largely depends the development of the guttural pouches. The mucous membrane of the tube has probably been dragged out of the tube by adhesion of the stylo hyoid bone with the membranous lamina and through it adhesion to the mucosa and stylo-hyoid has occurred. The development of depth of the mandible caused a descent of the larynx, with which organ were carried down the stylo-hyoid bones. The mucous folds once in the retropharynx were spread to their present confines by flexion and extension of the atlo-occipital joint, etc., through adhesion of the submucosa with the surrounding structures.

Atmospheric pressure has not produced these mucous sacs. They are to be found in the foetal foal; they are delicate sacs even in an old adult. Had they been submitted to pressure during life they should show considerable thickening. The entrance to these sacs is of sufficient size to prohibit pressure greater than atmospheric within these sacs.

The narrow and deep space through which passes the laryngopharynx is roofed by the base of the skull; walled by the unyielding branches of the mandible and the modified digastric muscle filling in the space between the wing of the atlas and the cervical border of the lower jaw; floored by the larynx

held firmly in the fairway of inspiration so that descent of the larynx is inhibited by the stylo-hyoid bones. Thus there is no provision outside the deep tunnel through which pass the larynx and pharynx for expansion of the pharynx during swallowing, etc. This tunnel-space runs into a dome extension in the roof. Down from the auditory tube into the dome of the retropharynx these loose folds of pouches extend themselves into a space, which, to borrow an expressive surgical term, may be termed dead space—a space formed by the developed depth of the jaw. In this space, enveloped by the mucous folds and encased by the submucosa, the superior ganglion of the sympathetic, the vagus, the hypoglossal, the glosso-pharyngeal, the spinal-accessory, the mandibular branch of the fifth nerves and the internal and external carotid arteries are found. These structures would, in this position, be damaged against such bodies as the lip of the articular surface of the atlas and the stylo-hyoid bone were it not that these folds endow the nerves and vessels with the power of passive movement during either co-ordinated or erratic muscular action. So freely do these nerves move in the exquisitely delicate submucosa that some difficulty is met in dissecting the pouches owing to the elusiveness of these structures to the forceps. A very important function of these pouches is the protection of these basal structures from injury. Without the pouches filling the dead space at the base of the skull (the retropharyngeal area) the grace of movement shown in the head and neck of the horse would be lost. They allow of free extension and flexion of the head, by the looseness of the folds with their delicate submucosa adapting themselves and their contained nerves to every movement so beautifully that nerve pressures or nerve pulls do not arise.

The air contained within these sacs probably plays some minor part in lessening the friction of movement by allowing the mucous surfaces to glide over one another with as little friction as occurs between serous surfaces. The guttural pouches represent tissues modified by force operating through the demands of speed and of food having developed depth and narrowness at the expense of breadth.